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NOTES

SPONTANEOUS TRIPLOIDY IN A NATURAL POPULATION OF THE FATHEAD MINNOW, *PIMEPHALES PROMELAS* (PISCES: CYPRINIDAE)

Among vertebrates, viable triploids appear rarely in nature, except for certain unisexual (all-female) populations of a few lower vertebrate groups, including fish (Cuellar and Uyeno, 1972; Bogart, 1980; Schultz, 1980). Outside of the latter, the reported incidence of triploidy in the wild is limited to scattered individuals of a few amphibians and reptiles (Cuellar and Uyeno, 1972; Witten, 1978), a fish *Hesperoleucus symmetricus*, (Gold and Avise, 1976), and two recent reports in fish that appear to involve interspecific hybridization and a unisexual mode of triploid propagation (Dawley, 1983; Dawley and Schultz, 1984). Among mammals and birds, triploidy is usually associated with embryonic mortality or early death (Bloom, 1972; Niebuhr, 1974).

Triploids have been produced experimentally in both fish and amphibians by means of thermal, pressure, or chemical shocks applied subsequent to fertilization (Thorgaard, 1983; Thorgaard and Allen, 1986). Presumably, these treatments suppress one of the meiotic divisions in female meiocytes and lead to the production of diploid eggs. In fish, viable triploids have now been produced using these methods in over ten species belonging to seven different families, and in a number of interspecific hybrids (Thorgaard and Allen, 1986). By all reports, the experimental procedures are relatively simple and generally result in high frequencies of viable and phenotypically normal triploids. Viable triploid fish also have been reported among artificially-managed (hatchery) populations of rainbow trout, *Salmo gairdneri* (Cuellar and Uyeno, 1972; Thorgaard and Gall, 1979).

In this note, the occurrence of a triploid individual from a natural population of the minnow, *Pimephales promelas*, is reported. This represents only the second instance of a viable triploid fish from a wild population of bisexually reproducing diploids. The apparently low frequency of spontaneous triploids in natural fish populations contrasts sharply with the frequency of triploids in experimentally-treated or hatchery populations.

The single triploid individual was found during a survey of genome size (nuclear DNA content) of North American cyprinid fishes, and was discovered among a sample of fifteen fathead minnows, *Pimephales promelas*, collected from Briar Creek (Red River drainage) in southern Oklahoma. The fish were collected by seine and returned live to College Station. Methods of processing, slide making, etc., are given in Gold and Price (1985), as are details of microspectrophotometry. Erythrocyte nuclei were measured for DNA content relative to an internal standard of chicken blood taken from a highly inbred strain. All specimens were deposited in the Texas Cooperative Wildlife Collection at Texas A&M University.

The genome size of the triploid individual was estimated as 3.33 (±.03) picograms of DNA based on measurements of over 100 erythrocyte nuclei taken from three different slides. Picograms of DNA per fish nucleus were estimated as the percent of the mean absorbancy of the internal standard on each slide multiplied by 2.5, the literature-accepted DNA value of diploid chicken erythrocyte nuclei (Rasch et al., 1971). The fourteen other *P. promelas* specimens exhibited a range of 2.17 to 2.28 picograms of DNA, clearly demonstrating that the exceptional individual was genetically triploid. All fifteen fish, including the triploid, were phenotypically normal and indistinguishable from one another.

The triploid *P. promelas* represents only the second reported instance of a triploid fish from the wild which is not associated with a unisexual mode of reproduction. In Table 1, a rough estimate of the number of fish examined in our laboratory for either genome size or karyotype is shown. Of all these, only two triploids, one identified by karyotype (Gold and Avise, 1976) and the one found here, have been reported. Based on these observations, the spontaneous frequency of triploids from wild, bisexually reproducing fish populations appears to be roughly one in twelve hundred. The actual frequency, however, is undoubtedly much lower given all the fish which have been examined for karyotype or genome size.

The low frequency of spontaneous triploids in wild fish populations contrasts sharply with both the apparent ease of triploid induction in fish using appropriate shock treatments of

TABLE 1.—Fish from natural populations examined for karyotype or genome size in our laboratory over the last ten years.

Family	# species	# individuals*	Parameter
Clupeidae	2	25	Karyotype
Salmonidae	5	150	Karyotype
Cyprinidae	>70	>1500	Karyotype
Cyprinidae	>50	>400	Genome size
Ictaluridae	5	100	Karyotype
Cyprinodontidae	2	10	Karyotype
Poeciliidae	2	15	Karyotype
Atherinidae	1	5	Genome size
Centrarchidae	5	50	Karyotype
Centrarchidae	20	>100	Genome size
Percidae	8	50	Karyotype
Cichlidae	2	15	Karyotype
Mugilidae	1	10	Karyotype
	>173	>2430	

*Approximate number.

fertilized eggs and the incidence of triploids in artificially-managed (hatchery) populations. Thorgaard (1983) and Thorgaard and Allen (1986) have recently reviewed the experimental work on triploid induction in fish and noted both the high frequencies of triploids that can be produced (in some cases from 50-100% of treated embryos surviving to the fingerling stage and beyond) as well as their obvious viability. Viable and phenotypically normal triploids have been found in hatchery populations of rainbow trout, *Salmo gairdneri* (Cuellar and Uyeno, 1972; Thorgaard and Gall, 1979) and in one instance represented six of eleven adults from a full-sib family. Finally, Dawley (1983) and Dawley and Schultz (1984) have reported the occurrence of several triploids in natural populations of sunfish and minnows, but in both cases the triploids appear to have stemmed from interspecific hybridization and a unisexual mode of reproduction.

From the above, it would appear that unlike most higher vertebrates, the triploid state in fishes is viable and the triploid individuals generally indistinguishable phenotypically from their diploid counterparts. The fact that triploids appear so rarely among normal, bisexually reproducing natural populations of diploids is puzzling, and most likely attests to the efficiency of the meiotic process in producing haploid gametes under natural conditions.

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RECORDS OF DESERT SHREWS (*NOTIOSOREX CRAWFORDI*) FROM BAJA CALIFORNIA, MEXICO

The desert shrew (*Notiosorex crawfordi*) is distributed widely across the southwestern United States and northern and western Mexico. However, details of its distribution are sketchy, particularly in Baja California. In this note, we review the published reports of desert shrews from Baja California and contribute four additional records.

Merriam (1895) reported the first specimen from Baja California from Santa Anita in the Cape Region. Hall and Kelson (1959) listed only this specimen from Baja California. Huey (1964:92) reported that "A mummy specimen in the S.D.N.H.M. [San Diego Natural History Museum], first preserved in tequila and then dried, was collected at Cape San Lucas, Baja California, by T. S. Brandegee in November of 1902." Huey made no mention of the Santa Anita specimen and speculated that *N. crawfordi* "probably occurs in suitable habitat over the length of the peninsula," apparently on the basis of the single specimen.

Schultz et al. (1970) reported a specimen from San Martin Island about 6.4 km off the Pacific Coast of northern Baja California near San Quintin. Armstrong and Jones (1972), Fisher and Bogan (1977), and Hall (1981) list no additional records of *N. crawfordi* for the peninsula.

Woloszyn and Woloszyn (1982) found one live specimen at Santiago and skulls of others in caves at Las Cuevas nearby. Both localities are in the Cape Region. Clark and Yensen (1982) used pitfall traps combined with aluminum drift fences and were able to collect two specimens near Rancho Santa Ines (Cataviña area), Baja California Norte. This record was 900 km north of the three records for the Cape Region and represented the first specimens known from the Central Desert. We subsequently collected *N. crawfordi* at two additional localities in the Central Desert and found two additional museum records. Because this information could not be included with the earlier paper, it is reported below.

On 24 June 1981, we collected an adult male *N. crawfordi* 3.2 km S. El Arco, Baja California Norte (lat. 28°00′N, long. 113°24′W, elevation 300 m). Three drift fence-pitfall traps (Clark and Yensen, 1982) were used at this site for two nights; the shrew was trapped on the first night. The traps were located in a sandy wash dominated by *Cercidium microphyllum*, *Viscainoa geniculata*, and *Acacia greggii*. The specimen (original number Eric Yensen 319) is deposited at the College of Idaho, Orma J. Smith Museum of Natural History (catalog number 98).

On 30 June 1981, we collected another adult male at El Crucero, Baja California Norte (lat. 29°16′N, long. 114°09′W, elevation 610 m). The ar was a sandy flat dominated by *Prosopis*